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The Cultivation of Groundnuts

With Special Reference to the Gambia.

BY

ARCHIBALD J. BROOKS, F.L.S., F.C.S.,

Director of Agriculture.

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THE CULTIVATION OF GROUNDNUTS WITH SPECIAL REFERENCE TO THE GAMBIA.

By Archibald J. Brooks, F.L.S., F.C.S.,
(Director of Agriculture).

The cultivation of the groundnut has been carried on in the Gambia for many years and at present forms the sole export crop of the Colony. The whole of this cultivation is undertaken by native farmers during the rainy season—June to October. Since the prosperity of the Colony depends entirely upon the successful annual production of this crop it is not unreasonable that special attention should be devoted by this Department to the several problems which call for investigation. The following advice, based upon the results obtained from field investigations conducted over a period of five years on our seed farms in the Protectorate, and from accumulated records and observations made on native farms, is offered in the hope that it may be of some practical help to those actually engaged in the groundnut industry.

As soil and climatic conditions vary considerably not only between the various Provinces but actually within each individual Province, the suggestions made must be taken to apply generally throughout the Protectorate, and in certain specific instances may require some slight modification to meet the actual local conditions, and where this is the case the advice of the agricultural officer should be obtained.

TYPES AND VARIETIES.

There are two general types of groundnuts grown for commercial purposes and this must be clearly understood at the time of sowing if the best results are to be obtained.

There is the *trailing* type which spreads over the surface of the ground producing nuts *along its stems*, and the *erect* type which does not spread over the ground but grows erect producing its nuts in a cluster at the base of the main stem. *No nuts are produced along the stems.* This difference in habit is important and must be remembered at the time of sowing if the correct distances of planting are to be observed.

Until the establishment of the Agricultural Department in 1924, only the trailing type was grown in this Colony, the erect type being recently introduced. As the Gambia crop is harvested by pulling the vines by hand, the advantages of the "erect" over the "trailing" type is readily seen, as few, if any, nuts are left in the soil and they are more easily dried. During the last five years the Agricultural Department has been experimenting

with a number of distinct varieties obtained from various countries in order to determine the more suitable variety for local conditions. Nineteen varieties are still undergoing trial at our seed farms, and some of these have already proved of sufficient value to warrant their general distribution.

The oil content of the seed varies considerably in the different varieties, and from a commercial point of view this is an important factor in the groundnut industry. Generally speaking the large-seeded varieties contained a lower oil content than the smaller-seeded varieties. The former are grown especially for the confectionery trade while the latter are cultivated solely for oil production. The Gambia is only concerned with groundnut production for the oil industry, therefore the aim is to produce nuts of the purest and highest oil content. All confectionery varieties are eliminated from our trials.

SEED SELECTION.

Careful selection of seed is one of the most important factors in the production of good crops. Two distinct operations are necessary. When the crop is harvested the brighest looking and *heaviest* nuts should be set aside for seed for the next season's planting. It is not sufficient to select the cleanest looking nuts without paying due regard to their weight. A bright coloured shell can, and often does, enclose a shrivelled kernel, but when good colour is combined with a satisfactory weight, the seed may reasonably be regarded as sound. Seed should be stored in a dry place with free circulation of air. This is all that can be done until the time for sowing arrives.

Seednuts should not be shelled until the ground has been prepared ready to receive them.

DATE OF SOWING.

This is a most important factor in the production of good nuts. The common error throughout the Gambia is *sowing too soon*. Serious losses are incurred each year by the practice of sowing immediately the first few showers have fallen. During the present season numerous instances have occurred where a third sowing had to be resorted to owing to the germinating seed of the first and second sowings not finding sufficient moisture in the soil to maintain life.

Our experience and investigations definitely prove that nothing is to be gained by early sowing. The crop matures within four months, and some varieties take only 12 weeks. Sowing should be carried out at a date which will enable the nuts to mature at a period when the rains are lessening. Sowings made in June are invariably destroyed by the frequent droughts of some days duration which usually occur during that month. Should they survive these droughts the crop is frequently seriously damaged owing to the nuts maturing while the heavy rains are still falling between the

middle of September and October. Our rainfall records for the various Provinces clearly show that the general distribution between July to October is ample for the production of groundnuts. Much better nuts and heavier yields would be obtained if farmers would make it a general rule not to sow any groundnuts until after the end of June each year. *The best time for sowing groundnuts in this Colony is from 1st to 15th of July* and this applies to the whole of the Protectorate. Sowing before this date will involve much extra work, and losses will be incurred through the necessity for second and third sowings. Further serious loss is suffered if the nuts ripen while the soil is still saturated with heavy rains. Experience also indicates that disease is less likely to prove troublesome if sowing is undertaken during the early part of July.

The Average Annual Distribution of Rain in the various Provinces of the Protectorate for 1927 was as follows :—

Province.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Total.
Upper River	3.73	4.29	4.37	13.04	12.54	9.86	2.21	Nil	50.04
MacCarthy Island.	2.52	3.82	5.57	13.45	8.57	7.16	1.01	„	42.10
South Bank	3.37	5.09	4.09	14.31	10.55	6.71	1.28	„	46.40
North Bank	2.87	4.22	4.57	14.11	11.99	6.46	0.60	„	44.82
Kombo & Foni.	0.57	7.09	8.99	25.34	15.50	6.06	2.25	.04	65.84

From these figures it will be seen that early July is the most favourable time for sowing groundnuts.

PREPARATION OF SOIL.

The groundnut demands a light well drained soil if maximum yields are to be obtained. There are two methods of planting and each has its particular advantage. Where the land is inclined to be heavy and likely to suffer from being water-logged during heavy rain it should be ridged.

Where the soil is loose and well drained better crops will be obtained by levelling the surface before sowing. This difference in the method of

planting on ridges or the flat is important as one frequently sees farms which have been unnecessarily ridged suffering considerable damage through the light soil being washed down and the roots of the young growing plants left exposed to the sun. On the other hand one often sees large patches of groundnuts dying out through having been planted on the flat in swampy localities. Whichever method is used the soil should be thoroughly worked up into a fine tilth before sowing.

FINAL SEED SELECTION.

The land having been prepared, the nuts should be shelled and the final selection made. A great improvement in the yield can be made by *careful selection of seed kernels at this stage.* Only the large and plump kernels free from decay should be selected, and all withered or shrivelled nuts and those with dark coloured skins should be discarded.

DISTANCE OF SOWING.

Yields are considerably influenced by the distance at which the seeds are sown. The correct distance is that which will give the best results according to the type of plant grown. The *erect* type should be sown in rows 6 inches apart and 18 inches between the rows. The trailing type requires more room and should be sown in rows 16 inches apart with 2 ft. between the rows. From 40 to 50 lbs. of shelled seed is required to plant an acre. Two seeds should be planted in each hole about an inch deep.

AFTER CULTIVATION.

The land should be kept free from weeds and the soil around and between the plants should be maintained in a loose condition until the flowers begin to fall and their "pegs" begin to penetrate into the soil. If the ground becomes hard the "pegs" cannot enter the soil in which case they wither and no nuts are formed. If grass and weeds are allowed to grow, the plants cannot spread and are forced into an upright habit of growth which will in the case of the trailing type, prevent the "pegs" from reaching the soil and so reduce the crop. Grass and weeds also rob the young groundnuts of the plant food which is essential for their development. If groundnuts are sown at the correct distances the soil is kept in a moist condition by the shade from the plants which excludes the sun's rays and prevents the soil from drying and becoming hard.

If the nuts are sown in July they should be ripening during October when the rains are practically over. It requires sound judgment to decide accurately when the nuts should be pulled, and no hard and fast rule can be laid down. Ripening, even on the same farm is very irregular, and the farmer alone must decide for himself when is the best time to reap. If he reaps too soon, many of the nuts will be immature and result in shrivelling, on the other hand should they be left too long in the ground the vines become brittle and many nuts will be left in the ground. When the plants have assumed a pale yellowish-green colour and the majority of the

leaves have fallen, tests should be made by pulling up a few plants at different parts of the plot; the condition of these will enable the farmer best to decide whether to reap at once or delay reaping for a few days.

HARVESTING.

When the leaves begin to turn yellow it is a sign that the nuts are maturing. Harvesting must be carried out during a dry period or the ripened nuts will quickly develop moulds if allowed to become wet. The local method of harvesting by hand is quite satisfactory if carried out at the right time. The soil should be first loosened around the plants which are then pulled up by hand. The plants with nuts adhering should be spread out with the vines turned down exposing the nuts to the sun for two days before they are stacked upon platforms in the open field.

It is now the general custom to stack the nuts while curing on temporary platforms erected in the field made from bamboos or rhun palms. The cross sticks forming the base of these platforms should be spaced as wide apart as practicable to admit a free circulation of air and should be raised at least 2 ft. from the ground. The more open the stack is kept the quicker will the curing be effected and the less likelihood there will be of moulds developing. The top of each stack should be covered with a grass mat to prevent the nuts becoming wet from an occasional light shower or from heavy dews. *Should the nuts become wet the stacks must be opened up at once* and the nuts spread out again in the sun.

From experiments conducted by this Department it has been found that where nuts have become wet while in the stack heavy black moulds have been produced within eight hours, and within twenty-four hours the nuts have been penetrated and seriously damaged. The bad quality of the Gambia crop last season was almost entirely due to this one cause, and could have been prevented if the above advice, urged at the time by the agricultural officers, had been followed.

YIELDS.

The yield per acre varies considerably according to general treatment, the variety, and climatic conditions. *Clean weeding and sowing at the right time* are probably the two most important factors affecting the yield which can be controlled by the farmer.

From a number of tests made on native farms it would appear that the average yield under normal conditions is from 800—900 lbs. of unshelled dried nuts per acre. This yield can be considerably increased by improved cultivation as is clearly shown by the following results obtained at our Cape St. Mary farm.

Variety	*Yield per acre. (Dried Nuts)*
	lbs.
Basse	2,832
Philippine White	2,721
Gambia	2,055
Philippine Pink	1,932
Zaria	1,681
Mauritius	1,232
Senegal	1,193
Cayor	1,120
Rufisque	1,002

DISEASES.

"ROSETTE DISEASE".

The most serious disease threatening the groundnut industry in the Gambia is that known to the native farmer as "Teo Jankero" and to the Specialist as "Rosette or Virus disease". This disease has limited the production of groundnuts in some countries and is widely spread throughout the Protectorate. For this reason it has received considerable attention by this Department and the results of these investigations have been published in the Annual Report for 1927—1928 to which the reader is referred for details.

Plants infected by rosette are usually dwarfed and assume more or less the general form of a rosette. The young leaves in some cases turn either white or pale yellow with dark green blotches. In badly affected plants the leaves are frequently curled and deeply mottled. It is sufficient for our present purpose to record that this disease is transmitted from plant to plant by a small insect in much the same way as yellow fever is conveyed from one person to another by the mosquito. The insect carrier—specimens of which may be seen at the Agricultural Station, Cape St. Mary,—appears to be most active between the middle of July and the middle of August. Infection is carried over from year to year by groundnuts left in the ground from the previous season.

EFFECT OF "ROSETTE" ON THE YIELD.

The general effect of this disease upon the plant may be broadly stated as follows:—

(1) The plant is restricted in growth.

(2) Severely infected plants are rendered barren.

(3) In slightly infected plants "Empty Shells" are increased up to 55 per cent making the nuts "light".

(4) The number of good nuts borne by slightly infected plants are reduced to 36 per cent.

Fortunately this disease is not carried in the seed or soil. Good crops have been raised from seed obtained from infected plants, and land in which heavy infestation of rosette has appeared the previous season has produced a good crop free from infection the following year.

SUGGESTIONS FOR CONTROL OF "ROSETTE".

The first line of defence is to immediately destroy all infected plants as soon as observed. These should be burned or buried in the ground. All groundnuts left in the soil during the previous year should be uprooted as soon as they appear above ground as these plants enable the disease to be carried on from one season to another.

RAISING OF IMMUNE VARIETIES.

The production and multiplication of varieties showing resistent properties to the virus has received much attention by this Department at Cape St. Mary and three varieties have given promising results during the last four years.

LEAF SPOT.

Another disease common to all groundnut farms is that known as "Leaf Spot". Affected plants produce a number of bright yellow spots with dark brown centres on the leaves. Late planted nuts suffer more from this disease than early sowings. The aim should be to get all sowings completed between 1st—15th July. This disease is generally more serious in cultivation on land containing an excess of moisture. In slight infections little damage beyond the defoliation of the plant is experienced but in heavily infected plots the defoliation may become so great as to seriously interfere with the growth of the plant. The best remedy for the farmer to follow is to change the crop next season and rest the land from groundnuts. Coos is a good crop to follow groundnuts when "Leaf Spot" has proved troublesome.

DISTRIBUTION OF IMPROVED VARIETIES.

The following varieties which have proved satisfactory under our field trials are being propagated and passed into general distribution as fast as production will permit.

Details of the analyses of these varieties are as follows :—

Variety.	Average weight of kernels.	Moisture in kernels.	Yield of Oil.		
			Expressed on kernels as received.	Expressed on moisture free kernels.	Expressed on entire nuts.
	grams.	per cent.	per cent.	per cent.	per cent.
Mauritius ...	0.52	5.1	50.9	53.6	39.7
Basse ...	0.49	4.9	50.0	52.6	39.0
Gambia ...	0.43	5.0	49.9	52.5	37.9
Philippine White	0.57	4.7	50.9	53.4	39.2
Philippine Pink	0.46	5.4	46.0	48.6	35.4
Senegal ...	0.34	4.9	49.6	52.2	39.2
Baol ...	0.39	4.8	50.4	52.9	40.3
Zaria ...	0.55	4.8	49.4	52.4	38.9

GOVERNMENT DISTRIBUTION OF SEED.

The quality of selected seed distributed during 1927—1928 was 13,992 bags of four bushels as follows :—

Province.	*Bags containing Four Bushels 1927.*
Upper River	5,316
South Bank	5,163
MacCarthy Island	2,800
Kombo and Foni	471
North Bank	242
	Total 13,992

Table showing Population and Quantity of Groundnuts purchased in each Province 1927—1928.

Province.	Area. Sq. Miles.	Population.	Groundnuts. Tons.
Upper River ...	703.8	34,011	22,469
North Bank ...	813.8	63,237	15,172
South Bank ...	925.0	39,768	14,954
MacCarthy Island ...	565.9	28.860	12.200
Kombo & Foni ...	990.1	34,425	10,591
TOTALS ...	3,998.6	200,301	75,386

COMMERCIAL ASPECTS OF THE CROP.

The rules of the Incorporated Oil Seed Association for Fixing Allowances on West African Groundnuts in the Shell state that "nuts may contain 2 per cent of their weight in dust or foreign matter without sellers having to pay an allowance". "Foreign Matter" includes everything not groundnuts—sand, stones, sticks, leaves and so forth. "Empty Shells" are also included within this 2 per cent. The rule reads :—

"It being admitted that sound groundnuts are composed of 75 per cent kernel and 25 per cent shell any excess of shell over this proportion shall be taken as valueless and allowed to the Buyers."

Previous to the coming into force of the Compulsory Screening Ordinance in 1924, Gambia cargoes of groundnuts were heavily penalized for greatly exceeding this 2 per cent. Since screening became compulsory the average adulteration has been within the percentage allowed.

FACTORS GOVERNING "EXCESS SHELL".

When nuts contain less than 75 per cent kernel there is an "excess of shell" and this is penalized. It is this excess of shell which constitutes the difference between what is known locally as "light" and "heavy" nuts. A number of factors contribute to this unsatisfactory feature of a crop such as unfavourable climatic conditions, disease, or insect pests. The greatest danger of all in this respect is that of *pulling the nuts before they are mature.* The crop may have grown under the very best soil conditions and have experienced the most favourable weather throughout the growing

and ripening period, but notwithstanding these advantages *the crop can still be partially or totally ruined by pulling too soon*, and from numerous observations in the field it is evident that this is the most common error in groundnut cultivation in the Gambia. Farmers are afraid of leaving the nuts too long in the ground for fear of the soil hardening, and this would entail much extra labour in reaping. The losses are, however, much greater if pulling is done too soon but of course the extra labour is avoided and this tells with the farmer. If the correct time for reaping was more accurately gauged we should not hear so many complaints of "light" nuts.

Eight varieties grown at the Agricultural Station, Cape St. Mary, and forwarded to the Imperial Institute for examination were reported upon as follows—

Variety.	*Shell per cent.*	*Kernel per cent.*
Baol	20	80
Senegal	21	79
Basse	22	78
Mauritius	22	78
Zaria	22	78
Phlippine Pink	23	77
Philippine White	23	77
Gambia	24	76

All eight varieties were above the standard adopted by the trade.

BAD KERNELS.

Bad kernels are undoubtedly the worst feature of a crop and requires careful attention. The presence of bad kernels lowers the value of the extracted oil since it is impracticable to separate the bad nuts from the good when a large consignment is received at the Oil Mills. This feature of a crop is heavily penalized by the trade, and rightly so.
Under the Rules previously referred to "Bad Kernels" are classified in four categories viz:—

1. "Kernels completely black, burnt, dark, chestnut, of offensive smell, mouldy, damp or dry". Penalty 40 per cent.
2. "Kernels with the outside and or inside black and having parts white". Penalty 30 per cent.
3. "Kernels completely light chestnut "cafe au lait" or yellow". Penalty 20 per cent.
4. "Kernels light yellow, citron, with any speck whatever or a taint of rancidity". Penalty 10 per cent.

Additional penalties are imposed as "Exceptional Allowances" according to the variations in the percentages of "Bad Kernels".

From the foregoing it will be seen how very necessary it is for all concerned in the groundnut industry to work together for the elimination of these unfavourable features. The farmer, trader, dealer and agent are each dependent upon the other in this matter. Farmers should refrain from mixing any bad nuts they may possess with their good nuts. Traders should refrain from buying bad nuts for the sole purpose of increasing their tonnage. As long as there are buyers of bad produce, bad produce will be forthcoming. Once farmers find that they cannot obtain a sale for inferior produce they will increase their efforts to produce what is saleable. Bad kernels may be due to several causes. Too much rain during the ripening period is invariably the chief cause, and this can largely be avoided by sowing early in July instead of June. Sometimes, a heavy shower of rain may fall after the vines and nuts have been stacked for drying, should this happen, *the stack must be immediately opened up and the nuts spread out to dry.* The quicker they dry the less damage there will be.

LEAKY PUMPS.

Leaky pumps on cutters engaged in transporting the crop from wayside stations are frequently the cause of bad kernels. I have seen nuts massed together in a rotten condition around the body of a leaking pump on board these craft, and although such cases may be considered trifling, it is a number of such trifling cases which in the long run materially affect the crop as a whole.

SCREENING.

Screening cannot, and does not, remove *bad* kernels. It will remove *broken* kernels, sand and other extraneous matter, but not large pieces of dried sticks and vine. Pieces of vine and stems should be removed by hand at the time of winnowing in the field, before the nuts are brought to the buying station. Complaints are often received from buyers that the produce has not been sufficiently freed from pieces of vine. Upon investigation it has been frequently found that the producer was actually urged by the trader not to stop to clean his nuts but to bring them in "one time". The remedy again is obvious. If nuts arrive at the screen containing too large a percentage of extraneous matter they should be picked over by hand before being passed through the screen.

BROKEN NUTS.

Broken nuts should be avoided as much as possible as they seriously affect the quality of a cargo. Once the nut is broken the oil of the kernel becomes exposed to the air and rapidly undergoes a change which increases what is known in the trade as Free Fatty Acid. This unsatisfactory feature of the crop before screening came into force reached a maximum of 12.5 per cent and average 4.75. Since the establishment of the Agricultural Department this average has been reduced to 1.05 per cent. It is quite untrue that screening is the cause of broken nuts. Sound nuts are incapable of being broken in the standard official screen even when the screen is rotated at a speed much greater than that for which it was designed. This excuse has, however, been sometimes advanced when complaints of an excess of broken nuts have been received. The chief

cause of broken nuts is that sacks filled with nuts are used as steps by the labourers to reach the top of the groundnut stack. These stacks are often 40 to 50 feet in height and the action of a number of labourers laden with nuts treading on these sacks throughout the day reduces the nuts to dust.

In many cases these sacks of broken nuts are emptied upon the main stack of nuts awaiting shipment, instead of being discarded or used for some local purpose. Such action has often resulted in the necessity for ordering the whole stack to be rescreened before shipment ; a measure irritating to all concerned. *Sacks stuffed with straw or dried grass would entirely remove this unsatisfactory feature.*

ADULTERATION BY DRIED MUD.

Farmers in many instances are now deliberately mixing small stones and dried pieces of mud, known as "putter, putter" with their groundnuts. This is fast becoming an alarming practice and unless it is effectively stopped very serious results will follow. At almost every buying station during the present trading season labourers had to be employed in removing by hand this foreign matter. In one instance the writer removed 11b. 3ozs. of dried mud from a standard bushel of groundnuts taken from a stack of several hundred tons at a wharf town.

Screening will not eliminate this adulteration, and it is impossible for the firms to remove the whole of it before buying, as the congestion which this would cause at the buying stations would hold up the trade.

The farmers themselves must be made to realise that such actions can only have but one result, and that is to lower the prices paid for produce, and unless voluntary action is taken it will be necessary in the interests of the industry for Government to resort to legislation.

LOOSE SAND OR CONCRETE BASES FOR GROUNDNUT STACKS.

The practice of placing screened nuts upon loose sand to await shipment is still much too common. Concrete bases enables quicker loading and ensures the cargo being loaded in a clean condition. No useful purpose is served by eliminating sand in the initial stage of buying if it can be so readily added again when loading for the final shipment.

Most firms have provided concrete bases, and it is to the interest of the industry as a whole that others should follow their good example.

Table showing the Annual Export of Groundnuts during the last five years :—

Year.	*Tons.*	*Annual Increases.*
1923/4	58,980	—
1924/5	* 46,583	—
1925/6	57,344	10,761
1926/7	65,107	7,763
1927/8	** 75,386	10,279

From the foregoing it will be seen that there are many factors calling for special attention if the present progress is to be maintained and developed. With the co-operation of all parties concerned in the groundnut industry I see no reason why the output of groundnuts in the Gambia should not be considerably increased.

ARCHIBALD J. BROOKS,
Director of Agriculture.

September, 1928.

NOTE:— * Decrease largely due to Compulsory Screening coming into force which removed all sand from the crop.

** Quantity actually purchased but export not completed to date.